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Forest Insect and Disease Conditions in the Southwest — 1979

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Forest Insect and Disease Conditions in the Southwest — 1979

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Foreword

This report documents the major forest insect and disease infestations that occurred in the Southwestern Region in 1979. It was compiled by the Forest Insect and Disease Management staff in the Regional Office, and also includes reports of conditions on State and private lands in Arizona and New Mexico by the respective state entomologists. The Forest Insect and Disease Management (FIDM) Staff Unit consists of a director, five forest entomologists (one of whom is a pesticide specialist), two forest pathologists, a supportive staff of specialized biological technicians, and clerical personnel.

Pest management must be considered as an integral part of forest management because pest-caused damages can significantly affect management objectives. The role of the pest management specialist is to advise the forest manager, and close coordination between the two is needed in making decisions in prevention, suppression, and long-term management plans. In their role as staff specialists, FIDM personnel are available to any Federal, State, or private land manager in the Southwestern Region.

In dealing with forest pests, entomologists and pathologists have used and continue to emphasize the use of Integrated Pest Management (IPM). In its most basic terms, IPM involves the use of a variety of control methods—biological, chemical, and silvicultural—either singly or in combination. Since many of the effects of forest pests can be prevented, pest management techniques should be incorporated in the beginning stages of any forest management planning.

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Insect and Disease Conditions

Conditions in Brief

Loss of growth and mortality due to southwestern dwarf mistletoe in ponderosa pine continued to be the most important effects of forest diseases in the Southwestern Region. Mistletoe surveys were conducted on approximately 3,100 acres on several National Forests in the Region for input into a simulated yield program (RMYLD). Results from surveys and computer runs were used to train Ranger District personnel in the use of the program and to determine management practices for mistletoe-infected stands.

A control project on the Kaibab National Forest was started in 1979. Mistletoe-infected overstory trees on 1,800 acres are being killed to protect seedlings in plantations installed under the infected trees.

In cooperation with Rocky Mountain Forest and Range Experiment Station and Region 3, researchers from the University of Arizona collected data on the incidence and growth loss associated with Douglas-fir dwarf mistletoe.

A root disease complex involving two species of fungi caused mortality in corkbark fir on the Apache-Sitgreaves National Forests.

Ponderosa pine seedlings were killed by charcoal root rot in plantations on several Forests. Researchers from New Mexico State University confirmed black stain root disease on beetle-killed ponderosa pine. The disease was also identified on dead ponderosa in Arizona.

Fusarium sp. caused minor losses in 1-0 ponderosa pine at the Albuquerque Tree Nursery. Large amounts of irrigation water, applied to prevent soil crusting, may have contributed to the development of the disease. Because of lack of mycorrhizal formation on seedlings at the nursery, a study installed in cooperation with the

Mycorrhizal Institute in Athens, Ga., has been terminated. Populations of possible pathogenic soil-inhabiting fungi and nematodes were monitored at the nursery. Both pre- and post-fumigation sampling for potential damaging soil fungi will be done on an annual basis in the future.

Abnormally cold winter temperatures caused widespread winter damage to several species of conifers in northern Arizona and New Mexico.

Damage to pine seedlings by gophers and to larger trees by porcupines was common throughout the Region. Bears girdled and killed corkbark fir on the Apache-Sitgreaves National Forests.

Aspen shoot blight, aggravated by a wet spring, caused premature defoliation in several areas in the Region.

Tree mortality resulting from bark beetle activity continued in Region 3, but at relatively low levels. Scattered ponderosa pines, singly and in small groups, were killed by the mountain pine beetle. Mortality by this insect occurred primarily in the northern portions of the Region. Western pine beetle activity, although somewhat lower than last year, continued to cause widely scattered pine mortality throughout the ponderosa pine belt in central and southwestern New Mexico. Roundheaded pine beetle activity continued to decrease, with only localized pockets of tree mortality occurring on the Lincoln National Forest and the Mescalero Apache Indian Reservation, N. Mex. Engraver beetle populations decreased to near endemic levels. Abundant and well-spaced precipitation may have helped reduce tree losses by *ips* beetles.

Outbreaks of certain defoliating insects increased in 1979, while others decreased. Acres defoliated by the western spruce budworm increased from 77,000 acres in 1978 to over 131,000 acres in 1979. Areas where the greatest increases occurred included the Kaibab National Forest and Grand Canyon National Park in Arizona and the Carson National Forest in New Mexico.

Douglas-fir tussock moth defoliation to Douglas-fir and white fir decreased markedly on the Santa Fe and Cibola National Forests. Only two of the eight tussock moth infestations reported last year continued into 1979. Tussock moth populations in Arizona remained at low levels.

Defoliation by the western tent caterpillar continued on the Santa Fe National Forest, N. Mex., for the fourth consecutive year, causing moderate to heavy defoliation of aspen.

A pandora moth outbreak, occurring for the first time in 30 years,

defoliated 5,120 acres of ponderosa pine on the North Kaibab Ranger District, Kaibab National Forest. The heaviest defoliation occurred about 2 miles west of Jacob Lake, Ariz.

Damage to ponderosa pine cones by several seed and cone damaging insects was reported on many National Forests in the Region, as well as on cones shipped to the Albuquerque Tree Nursery.

Status of Insects

Mountain pine beetle, Dendroctonus ponderosae Hopk. The mountain pine beetle continued to cause widely scattered ponderosa pine mortality throughout the northern portions of the Region (Table 1). Tree mortality increased in Arizona, but remained relatively low in New Mexico. Salvage logging was not undertaken because dead trees were scattered or inaccessible.

In Arizona, an increase in ponderosa pine mortality was observed on the Kaibab Plateau, Kaibab National Forest and the adjoining Grand Canyon National Park. On the eastern portions of the North Kaibab Ranger District, individual "faders" and groups of up to 30 dead trees were detected. Most of the beetle-killed trees were located in reserved amd roadless areas; as a result, salvage logging was not undertaken. On the north rim of the Grand Canyon National Park, groups of 50-60 mountain pine beetle-killed trees were observed near the junction of Imperial and Cape Royal roads. Single trees and groups of 2-5 mountain pine beetle-killed trees were also widely scattered throughout the Park. Survey results for the Forest and the Park indicated tree losses will continue in 1980.

In northern New Mexico, continuing the trend of the last several years, isolated mountain pine beetle infestations continued to cause tree losses. Tree mortality during the past year occurred on the El Rito, Penasco, and Tres Piedras Ranger Districts, Carson National Forest and the Cuba, Espanola, Las Vegas, and Pecos Ranger Districts, Santa Fe National Forest. Although beetle-killed trees were not salvage-logged on these Districts, many of the dead trees were utilized by fuelwood cutters.

Low levels of mountain pine beetle activity also ontinued in the Chuska Mountains in northeastern Arizona and northwestern New Mexico, on the Navajo Indian Reservation.

Western pine beetle, *Dendroctonus brevicomis,* LeC. This bark beetle caused widely scattered tree mortality throughout much of the

ponderosa pine belt in central Arizona and southwestern New Mexico (Table 1). Tree losses remain relatively constant from year to year because large, decadent trees weakened by lightning strikes, fire, disease, and other factors are favored by these beetles. Localized increases in tree losses can occur, but salvage logging is usually uneconomical.

In 1979, tree losses due to this beetle were heaviest on the following forests and Indian reservations.

Arizona
- Apache-Sitgreaves National Forests
- Coconino National Forest
- Kaibab National Forest
- Tonto National Forest
- Fort Apache Indian Reservation
- San Carlos Indian Reservation

New Mexico
- Apache-Sitgreaves National Forests
- Gila National Forest
- Lincoln National Forest

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. The amount of ponderosa pine mortality caused by this beetle has been decreasing in Region 3 since 1975. In 1979, minor tree mortality continued to occur on the Sacramento, Lincoln, Mayhill, and Cloudcroft Ranger Districts, Lincoln National Forest, N. Mex. Most of the mortality occurred in the Sacramento Mountains of the Lincoln National Forest and adjoining Mescalero Apache Indian Reservation, N. Mex. In Arizona, incidental tree losses occurred on the Douglas Ranger District, Coronado National Forest.

Engraver beetles, *Ips* spp. Ponderosa pine mortality resulting from the Arizona five-spined ips, *Ips lecontei* Sw, and other engraver species decreased for the second consecutive year. No infestations of any consequence occurred in the Region in 1979. Abundant and well-spaced precipitation, which increased tree vigor, helped to reduce tree losses. Also, one or more preventive measures used by forest managers also helped to avert tree losses over thousands of acres where timber harvesting occurred. These preventive measures included: 1) harvesting of trees to a 4-inch top; 2) cutting trees in late summer to facilitate their drying and to make them an unsuitable habitat; 3) avoiding timber and fire management programs that create slash

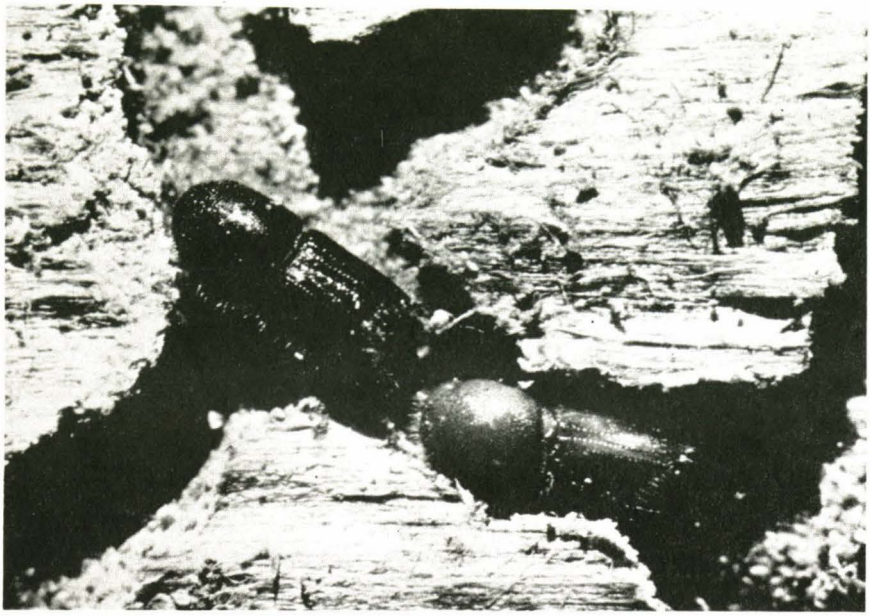

Figure 1. Ips engraver beetles in gallery.

and/or weaken trees; and 4) timely disposal of pine slash which would otherwise favor beetle buildups.

Western spruce budworm, *Choristoneura occidentalis* Free. Acres of visible budworm defoliation increased throughout the Region from an estimated 77,000 acres in 1978 to 131,000 acres in 1979 (Tables 1 and 2). Increases in defoliation occurred in the light to moderate classes, but decreased in the heavy class. Areas showing the greatest increase in acres of defoliation were on the Kaibab National Forest and the Grand Canyon National Park in Ariz., and on the Carson National Forest in N. Mex.

Numbers of egg masses per square meter of foliage increased in all areas, indicating an increasing population trend.

Sampling continued on the western spruce budworm suppression and evaluation project in the Jemez Mountains, Santa Fe National Forest, N. Mex. Budworm populations remained low in the area treated with carbaryl in 1977 for a third consecutive year. Table 3 shows the population trend of the treated and untreated areas based on the number of larvae per 100 buds and number of egg masses per square meter of foliage.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.) In New Mexico, Douglas-fir tussock moth defoliation of Douglas-fir and white fir decreased markedly on the Santa Fe and Cibola National Forests (Table 1). Only two of the eight active tussock moth infestations recorded last year continued in 1979. Aerial surveys over Medio Dia, Cochiti, Nambe, Los Alamos, and Pueblo Canyons (Santa Fe National Forest) in the spring and early summer revealed no additional defoliation. Defoliation in Bear and Trigo Canyons (Cibola National Forest), however, continued, but at light to moderate levels. An egg mass survey in Trigo Canyon indicated light defoliation would continue in this canyon in 1980.

In New Mexico, suppression projects were conducted on the Santa Fe National Forest and private land in a cooperative program between Federal, State (Division of Forestry of the New Mexico Department of Natural Resources and the Plant Industry Division of the New Mexico Department of Agriculture), and private (Albuquerque Academy) organizations. In these projects, a nucleopolyhedrosis virus was aerially applied to 800 acres on the Santa Fe National Forest and 600 acres in Bear Canyon in the Elena Gallegos Grant, N. Mex. Suppression activities reduced larval populations to acceptable levels. In Arizona, tussock moth populations remained at low levels on the Tonto National Forest (Table 1).

Western tent caterpillar *(Malacosoma californicum* (Pack.). Western tent caterpillar defoliation occurred in aspen stands on the Santa Fe National Forest for the fourth consecutive year (Table 1). Areas experiencing moderate to heavy aspen defoliation included the Coyote, Tesuque, and Espanola Ranger Districts. Defoliation was noticeably severe in and around the vicinity of Los Alamos and Bandelier National Monument, N. Mex. Throughout the infestation area, there was evidence of tent caterpillar mortality caused by a naturally occurring nucleopolyhedrosis virus.

Scattered patches of tent caterpillar defoliation also occurred on the Tres Piedras, Questa, Taos, and Penasco Ranger Districts, Carson National Forest, N. Mex.

Pandora moth, *Coloradia pandora* Blake. (Figures 2 and 3). Defoliation of 5,120 acres of ponderosa pine occurred on the North Kaibab Ranger District, Kaibab National Forest (Table 1). The heaviest defoliated area was about 2 miles west of Jacob Lake, Ariz., where 2,688 acres were heavily defoliated and 2,432 acres moderately

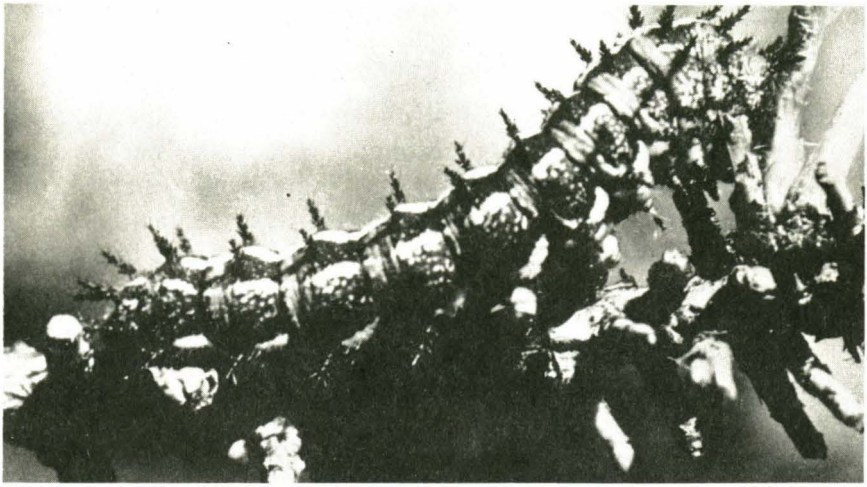

Figure 2. Pandora moth larva.

Figure 3. Defoliation of ponderosa pine by the pandora moth, N. Kaibab Ranger District, Kaibab National Forest, Ariz.

defoliated. Evidences of light larval feeding were also noted on several thousand additional acres.

Although many pine stands were completely defoliated, trees are expected to recover and only a few low-vigor trees are expected to die from the defoliation or from secondary attacks by bark beetles. Nevertheless, damage survey plots were permanently established in two stands to document potential tree losses over the next few years. These plots will be surveyed on a yearly basis to record tree losses.

The pandora moth has a 2-year life cycle with defoliation occurring every other year. Therefore, defoliation of the currently infested stands will not occur again until May and June of 1981. In 1980, moths will emerge in August and lay eggs on host trees. Small larvae will emerge from the eggs and overwinter at the bases of the needles in clusters. The density of larvae and the extent of the infestation will be evaluated in September of 1980.

Seed and cone insects. Ponderosa pine cones examined on the Kaibab and Coconino National Forests in Arizona had a high percentage of the seed infested with pine seed chalcid, *Megastigmus albifrons* Walk. (Figure 4). Throughout Arizona and New Mexico, heavy seed and cone damage in localized areas resulted from the ponderosa pine cone beetle, *Conophthorus ponderosae* (Hopk.), and to varying lesser degrees of infestation, from the pine cone worm,

Figure 4. Pine seed chalcid in ponderosa pine cone.

Dioryctria auranticella (Grote), and the ponderosa pine seed moth, *Laspeyresia piperana* (Kear.) Of the cone lots that were sampled at the Albuquerque Tree Nursery, approximately 7-10 percent of the cones were infested with *Laspeyresia.*

On the Apache-Sitgreaves National Forests, Ariz., resinosis, abnormal scale discoloration, and swelling resulted from a midge *(Cecidomyiidae)* infesting first year conelets of ponderosa pine (Figure 5).

Figure 5. Midge damage to ponderosa pine conelet.

Table 1: Estimated extent (acres) of insect infestations by State and ownership, Southwestern Region, 1979.

Insect	Ownership[1]	Acres Infested			
		Light	Medium	Heavy	Total
Arizona					
Western spruce budworm	NFS	34,355	18,099	1,357	53,811
	OF	32,180	1,152	—	33,332
	S	0	0	0	0
	P	0	0	0	0
	(Total)	66,535	19,251	1,357	87,143
Pandora moth	NFS	0	2,432	2,688	5,120
	OF	0	0	0	0
	S	0	0	0	0
	P	0	0	0	0
	(Total)	0	2,432	2,688	5,120
Mountain pine beetle	NFS	—	—	—	40,320
	OF	—	—	—	33,920
	S	—	—	—	0
	P	—	—	—	23,680
	(Total)[2]	—	—	—	97,920
Western pine beetle	NFS	—	—	—	179,200
	OF	—	—	—	0
	S	—	—	—	0
	P	—	—	—	33,120
	(Total)[2]	—	—	—	212,320
Other bark beetles[3]	NFS	—	—	—	38,400
	OF	—	—	—	0
	S	—	—	—	0
	P	—	—	—	9,600
	(Total)[2]	—	—	—	48,000

Table 2: Acres of visible defoliation by western spruce budworm in R-3 for the past 3 years.

	1977	1978	1979
L	177,000	26,000	82,000
M	25,000	30,000	40,000
H	3,000	21,000	9,000
Total	205,000	77,000	131,000

L = light, M = moderate, H = heavy

New Mexico

Western spruce budworm	NFS	12,073	15,451	8,108	35,632
	OF	0	0	0	0
	S	0	0	0	0
	P	3,533	5,351	0	8,864
	(Total)	15,606	20,802	8,108	44,496
Western tent caterpillar	NFS	7,040	5,120	3,840	16,000
	OF	0	0	0	0
	S	0	0	0	0
	P	0	0	1,280	1,280
	(Total)	7,040	5,120	5,120	17,280
Mountain pine beetle	NFS	—	—	—	76,160
	OF	—	—	—	0
	S	—	—	—	0
	P	—	—	—	0
	(Total)[2]	—	—	—	76,160
Western pine beetle	NFS	—	—	—	42,240
	OF	—	—	—	0
	S	—	—	—	0
	P	—	—	—	2,560
	(Total)[2]	—	—	—	44,800
Other bark beetles[3]	NFS	—	—	—	32,000
	OF	—	—	—	0
	S	—	—	—	0
	P	—	—	—	1,920
	(Total)[2]	—	—	—	33,920

1 Ownership: National Forest System (NFS), Other Federal (OF), State (S), Private (P).

2 Individual trees or groups of dead trees widely scattered over the acreages shown.

3 Other bark beetles include: Spruce beetle, Dendroctonus rufipennis *(Kby.); Roundheaded pine beetle,* Dendroctonus adjunctus *Blandf.;* Scolytus *spp.; and* Ips *spp.*

Table 3: Population trend of spruce budworm for treated and untreated areas in project area of the Jemez Mountains, Santa Fe National Forest, N. Mex.

	1977				1978		1979	
	Prespray		Postspray					
	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated
No. of larvae per 100 buds	14.9	12.4	1.0	6.9	0.9	8.7	0.8	8.9
No. of egg masses per sq. m.			1.7	9.9	0.4	10.1	0.6	15.8

Other Insects.

Name		Host	Locality	Remarks
Common	**Scientific**			
Aspen leaftier	*Sciaphila duplex* (Walsing.)	aspen	Santa Fe NF, N. Mex.	30-50 acres affected
Cedar bark beetle	*Phloeosinus* sp.	juniper	Jicarilla Apache Indian Reser., N. Mex.	
Engraver beetle	*Ips.* sp.	spruce	Apache-Sitgreaves NF's, Ariz.	
Fruit tree leaf roller	*Archips argyrospilus* (Walk.)	chokecherry	Carson NF, N. Mex.	Second year of defoliation, around campground areas
Pinyon needle scale	*Matsucoccus acalyptus* Herb.	pinyon pine	Gila, Lincoln, & Santa Fe NF, N. Mex.	Scattered
Red turpentine beetle	*Dendroctonus valens* LeC.	ponderosa pine	Kaibab NF, Ariz. Carson NF, N. Mex.	Scattered
Scarab beetle (a)	*Phyllophaga* sp.	ponderosa pine	T-Bar Grasslands & Gila NF, N. Mex.	Infestation reported in 1978 collapsed
Southwestern pine tip moth	*Rhyacionia neomexicana* (Dfar.)	ponderosa pine	Apache-Sitgreaves NF's, Ariz.	

Status of Diseases

Dwarf mistletoe, *Arceuthobium* spp. Southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Wiens, continued to be the most important disease of ponderosa pine in Region 3. Losses caused by this disease, in terms of both growth reduction and mortality, have been estimated to exceed 18 million merchantable cubic feet a year in the Southwest. Surveys conducted this year on approximately 3,100 acres of mistletoe-infected ponderosa pine on four Ranger Districts were used to input data into the RMYLD simulated yield program. Results of simulation runs were used by Ranger Districts to plan management activities in badly infected stands. Continued emphasis on the use of this program should eventually result in the incorporation of dwarf mistletoe management plans in all silvicultural activities in infected stands.

A mistletoe control project to kill infested overstory trees in plantations was started on the Tusayan Ranger District, Kaibab National Forest, Ariz. The few, badly infected overstory trees were poisoned by a silvicide, creating snag trees for wildlife use. Approximately 30 percent of the 1,800 acres have been treated this past year.

Researchers from the University of Arizona discovered a population of fir mistletoe *(Arceuthobium abietinum* f. sp. *abietinum)* on white fir in Marshall Gulch, in the Santa Catalina Mountains, Coronado National Forest, Ariz. This is only the second known location for the mistletoe in southern Arizona (it occurs in one small area in the Chiricahua Mountains). The closest known occurrence is at Grand Canyon National Park, nearly 250 miles north.

In an effort to gain badly needed information on Douglas-fir dwarf mistletoe, *A. douglasii* Engelm., a cooperative project was established between Region 3, Rocky Mountain Forest and Range Experiment Station, and the University of Arizona. Data on the incidence and growth of mistletoe-infected and uninfected Douglas-fir were taken on 150 plots in the White Mountains of Arizona. The project will continue in 1980 in New Mexico.

Root rots. A complex of *Fomes annosus* (Fr.) Cke. and *Armillaria mellea* (Vahl. ex Fr.) Karst. caused mortality in corkbark fir on the Apache-Sitgreaves National Forests, Ariz. The complex appears to kill trees with basal and root wounds 5 to 10 years after wounding. Both pathogens spread between trees via root contacts.

Seedlings were reported killed by charcoal root rot,

Macrophomina phaseoli (Maubl.) Ashby, from the Lincoln National Forest, N. Mex., and the Tonto and Kaibab National Forests, Ariz. This disease, a serious pathogen of pine species in nurseries, caused only small losses in outplantings.

Researchers from New Mexico State University confirmed the presence of black stain root rot, *Verticicladiella* spp., in beetle-killed ponderosa pine on the Lincoln National Forest, N. Mex. The fungus was isolated from stain in the roots, from beetle galleries, and from adult insects (*Hylurgops* spp.). This disease was also found on several dead ponderosa pine on the Prescott National Forest, Ariz.

Nursery diseases and mycorrhizae. Damping-off, caused by *Fusarium* spp., was responsible for minor losses in newly emerged ponderosa pine seedlings at the Albuquerque Tree Nursery. Losses occurred during May and June, much earlier than is normally expected, but did not exceed 1 percent of the seedlings in the section sustaining the heaviest losses. Heavy irrigation, necessary to wet the soil so that seedlings could emerge, probably allowed the fungus to develop.

Soil samples from nursery beds to be sown in the spring of 1979 were tested for population levels of *Fusarium* spp. and *Pythium* spp., both before and after fumigation. Results obtained from these samples, and from samples taken from areas to be sown in 1980, will be used to monitor the effectiveness of fumigation techniques at the Nursery. Monitoring of population levels of pathogenic fungi will be continued on a regular basis.

An evaluation of seedlings taken from test beds inoculated with the mycorrhizal fungus *Pisolithus tinctorius* (Pers.) Cooper and Couch indicated that so few roots, less than 1 percent, were infected that the study was terminated. High soil pH was the probable reason for the lack of mycorrhizal formation. This study was part of a nationwide nursery evaluation of *P. tinctorius* conducted in cooperation with the Mycorrhizal Institute in Athens, Ga.

Abiotic diseases. Special environmental conditions during an unusually cold and snowy winter in 1978-79 caused widespread winter damage to several species of conifers in northern Arizona and New Mexico. Species affected included ponderosa pine, pinyon pine, and juniper. Hardest hit were the junipers, which showed some mortality in certain areas of the Kaibab and Coconino National Forests, Ariz. As would be expected, damage was most severe on trees located on exposed areas and marginal sites. Damage to the pines consisted

of dieback of needles and smaller branches, and some mortality in seedlings.

Rocky Mountain Forest and Range Experiment Station reported that aerial shoots of oak mistletoe *(Phoradendron villosum* subsp. *coryae)* in the Fort Apache Indian Reservation, Ariz., were severely damaged by cold. All plants examined in the vicinity of Whiteriver, Fort Apache, and Cedar Creek had all shoots killed. It is not known if the root system of the mistletoe within the oak branches were also killed, so observations will be made to see if the mistletoe resprouts. The desert mistletoe *(Phoradendron californicum)* in the Salt River Canyon on Highway 60 was similarly damaged. The juniper mistletoe *(Phoradendron juniperinum)* occurs in the same area as the oak mistletoe on the Fort Apache Indian Reservation. This mistletoe is known to be quite frost-hardy and it was not affected. The damage was apparently associated with abnormally cold weather in early December 1978, when a minimum of -2° F (-18.9° C) was recorded on December 9, at Whiteriver, Ariz.

Because of the large amount of moisture in the previous winter and this spring, drought was not a problem in the Region in 1979; however, lack of moisture during June, July, and August caused mortality in some seedling plantations.

Animal Damage. Severe bear-caused damage to corkbark fir was observed on the Apache-Sitgreaves National Forests, Ariz. In one stand, 50 percent of the dead firs had been girdled and killed by bears.

Rodents girdled seedlings in several plantations on the Lincoln National Forest, N. Mex., and the Kaibab and Tonto National Forests, Ariz.

Aspen Diseases. Aspen shoot blight, *Napicladium tremulae* (Frank) Sacc., caused some defoliation in aspen stands in many areas of Region 3. Larger than average amounts of spring moisture contributed to the seriousness of the disease. Stands on the Carson, Cibola, Gila, and Lincoln national forests, N. Mex., as well as on the Coronado National Forest, Ariz., suffered some minor growth loss and mortality from the disease.

Final year data were taken on a cooperative study (Region 3, Region 2, and RM Station) evaluating diseases of aspen in trees remaining after logging. Data were taken on all trees on 11 study plots in New Mexico and Colorado. The most common canker found on trees was caused by *Ceratocystis fimbriata* Ell. & Halst.

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Rodents girdled seedlings in several plantations on the Lincoln National Forest, N. Mex., and the Kaibab and Tonto National Forests, Ariz.

Aspen Diseases. Aspen shoot blight, *Napicladium tremulae* (Frank) Sacc., caused some defoliation in aspen stands in many areas of Region 3. Larger than average amounts of spring moisture contributed to the seriousness of the disease. Stands on the Carson, Cibola, Gila, and Lincoln national forests, N. Mex., as well as on the Coronado National Forest, Ariz., suffered some minor growth loss and mortality from the disease.

Final year data were taken on a cooperative study (Region 3, Region 2, and RM Station) evaluating diseases of aspen in trees remaining after logging. Data were taken on all trees on 11 study plots in New Mexico and Colorado. The most common canker found on trees was caused by *Ceratocystis fimbriata* Ell. & Halst.

Other Diseases.

Name		Host	Locality	Remarks
Common	**Scientific**			
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.	white fir corkbar fir	Ariz. & N. Mex.	Found throughout mixed conifer forest type. Causing some top-kill and breakage due to bole infections. No estimate of volume lost.
Ink spot leaf blight	*Ciborinia* sp.	aspen	Coronado NF, Ariz. & Carson & Cibola NF's, N. Mex.	Scattered in aspen stands; some defoliation & associated growth loss.
Limb rust	*Peridermium filamentosum* Pk.	Ponderosa pine	Ariz. & N. Mex.	Caused branch & some tree dieback mortality. Important on seed trees & in cone collecting areas.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.	Engelmann & blue spruce	Ariz. & N. Mex.	Common in some areas of mixed conifer. Causes some top-kill & dieback.

Trunk Rots

Indian paint fungus	*Echinodontium tinctorium* (E. & E.) E. & E.	white fir	Ariz. & N. Mex.	Frequent on over-mature white fir. Large but unknown amounts of loss due to cull.
White heart rot (a)	*Inonotus dryophilus* Pers. ex Fr. (Polyporus dryophilus)	Gambel oak	Ariz. & N. Mex.	Distributed on all Forests.
White heart rot (a)	*Phellinus weirianus* Murr.	Arizona walnut	Coronado & Tonto NF's, Ariz.	Serious decay of walnut in campgrounds.

Forest Insect and Disease Management Activities in 1979

The Forest Insect and Disease Management staff of the USDA Forest Service is charged with responsibility for detection, evaluation, suppression, and technical assistance to land managers on all Federal lands in Arizona, New Mexico, and western Texas. In addition, they cooperate with and provide assistance to State forest pathologists and entomologists.

Detection Surveys

As one of its major responsibilites, FIDM detects and monitors insect and disease outbreaks and infestations. This is accomplished through a combination of both aerial and ground survey techniques. Aerial surveys are used to detect new outbreaks, monitor ongoing infestations, and determine the extent and location of damage. These surveys are conducted from low-flying aircraft in an organized and systematic manner.

A total of 14.58 million acres were surveyed by FIDM personnel from July through September, 1979.

State	Ownerships	Acres (millions)
Arizona	*National Forest*	*5.09*
	National Park Service	*0.16*
	Indian Lands	*1.79*
	Other Federal, State, & Private*	*0.10*
New Mexico	*National Forest*	*5.56*
	National Park Service	*0.02*
	Indian Lands	*0.56*
	Other Federal, State, & Private*	*1.30*
TOTAL		*14.58*

** Other Federal ownership includes Bureau of Land Mangement, National Monuments, Department of Energy, and U.S. Military installations.*

After the surveys are completed, maps showing the location, extent, and kind of outbreaks occurring are sent to the resource managers of the respective administrative units.

Field Surveillance

Land managers and forest workers should be alert for any unusual insect or disease activity as they conduct their normal field activities. Aerial surveys can usually only detect damage after it has occurred, while forest workers on the ground can often discover the beginning of a potential problem. Prompt reporting of new or unusual insect or disease activity is necessary for early detection of potential pest problems. Detection forms and surveillance kits are provided to land managers by the Forest Service and the State agricultural departments. State and private landowners should report on the form provided by the State. Federal and Indian Reservation land managers should report information on the Forest Insect and Disease Surveillance Work Sheet forms furnished by FIDM (Figure 6). Check appropriate boxes and make sure all pertinent information is provided. Probably the most important section of the work sheet is the "Remarks" section, in which the land manager can give a more detailed description of the problem. Often, it is the comments in the remarks section that are most helpful to pathologists and entomologists in identifying a problem.

Evaluation

FIDM not only informs land managers of existing and potential problems, but also provides evaluations containing recommendations on how to manage pest problems utilizing concepts of integrated pest management.

Entomology: Last year entomologists were involved in several new and continuing projects: 1) third-year monitoring of a western spruce budworm suppression and evaluation project on the Santa Fe National Forest, N. Mex., to determine long-term effects of treatment with carbaryl spray; 2) second-year loss assessment survey to determine tree damage and losses from western spruce budworm in relation to the population dynamics of the insect; 3) continuing cooperation with the Methods Application Group in Davis, California, to develop an improved western spruce budworm egg mass sampling system.

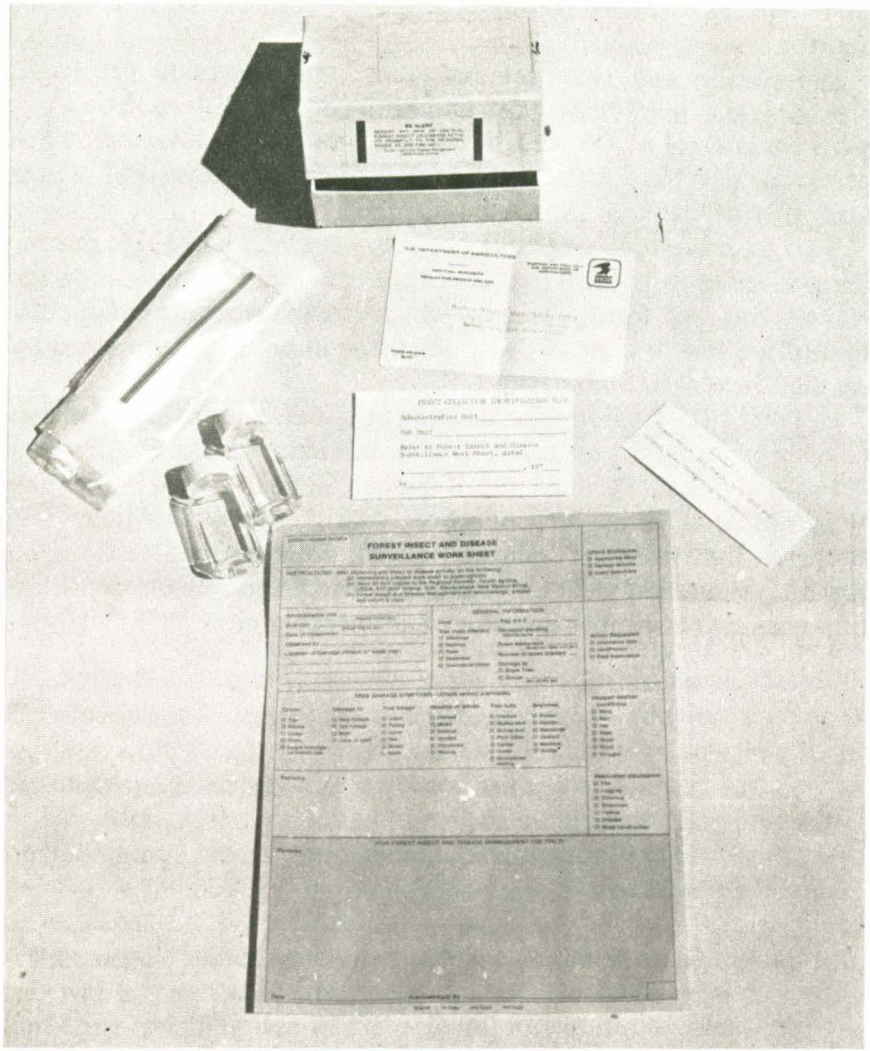

Figure 6. Forest Insect and Disease Surveillance Work Sheet and mailing kit.

Pathology: Major projects included: 1) a dwarf mistletoe evaluation of three campgrounds in Horsethief Basin Recreation Area, Prescott National Forest; 2) evaluation of residual dwarf mistletoe-infected overstory trees on the Mescalero Apache Reservation, N. Mex.; 3) evaluation of the role of root rot fungi in the death and decay of wounded corkbark fir on the Apache-Sitgreaves National Forests; hazard tree evaluations in six campgrounds on the Tonto National Forest and at the administrative site at the North Rim of Grand Canyon National Park; and 4) surveys totaling 3,100 acres on

four Ranger Districts to gather data for use in RMYLD for mistletoe control.

Suppression and technical assistance: A suppression project in New Mexico, involving aerial application of a nucleopolyhedrosis virus for control of Douglas-fir tussock moth was conducted on 800 acres of Forest Service land near Los Alamos and 600 acres of private land at Bear Canyon, near Albuquerque.

Two dwarf mistletoe control projects were begun in 1979; one using a silvicide to kill infected overstory trees on a plantation on the Kaibab National Forest, and the other using silvicultural manipulation of a stand to control dwarf mistletoe in an infected understory on the Lincoln National Forest.

In 1979, FIDM entomologists and pathologists participated in and conducted several workshops and training sessions for land managers. These included the Regional Silviculturist Certification Workshops; three Cone Collection Workshops; a Restricted-Use Pesticide Certification Training Session; four training sessions on RMYLD simulated yield program; and insect and disease identification training for timber inventory and marking crew.

State of Arizona Insect and Disease Conditions State and Private Lands

by Robert Celaya[1]

Bark beetle attacks on ponderosa pine were very apparent on State and private forested lands in 1979. Ips beetles caused most of the problems especially in and around forest communities. Mountain pine beetle were detected on overmature ponderosa pine in the Hart Prairie area of Flagstaff. This is the first time this beetle has been identified on private land, although it is known to occur in the general area.

Pinyon needle scale emergence occurred in late March in the Prescott area. This is very early in the year for this insect. Based on examinations of infested trees in 1978, a large buildup of these pests was not anticipated. However, defoliation and mortality to pinyon pine was the most serious on record in the last 4 years.

A conifer sawfly continued to defoliate pulp-size ponderosa pines on State land, west of Springerville. Defoliation was severe, but tree damages were minimal on this marginal site. No defoliation in stands on adjacent and better sites was noted.

Pine needle miner on ponderosa pine in the Show Low-Lakeside area was less noticeable this year than last. No evidence of tree mortality or top-killing due to the defoliation was discovered.

Frost injury to ponderosa pine and juniper was widespread throughout the higher elevations. No tree mortality to ponderosa pine was identified and early spring growth masked its effects. Small junipers were severely "burned," and some mortality did occur.

Brown spotting on Gambel oak leaves was reported in July and August in the Lakeside-Pinetop area. Further examinations of this host type in other parts of the State revealed the same symptom. No causal agent was identified, and no tree losses were recorded; trees should refoliate next spring.

1 *Forest entomologist with the Division of Forestry, Arizona State Land Department.*

Miscellaneous pest problems were encountered throughout the State, including roundheaded pine beetle, elm leaf beetle, spiny elm caterpillars, tip moths, bark and pitch moths, and spruce gall aphids. Leaf scorch, herbicide burn, and flagging on pinyon pine were also identified during the year.

Engraver beetle, *Ips* spp., damage to ponderosa and pinyon pine increased in 1979 in areas near Prescott, Flagstaff, Pine, and Payson. Most of the mortality occurred in and around these populated areas. Although overall losses in the forest appear to have decreased, attacks on trees visible to the public greatly increased. Technical assistance to landowners in the Prescott area surpassed last year, and the trend is expected to continue. Ips beetles also killed 150-200 ponderosa pine trees in and around Payson. Several trees were salvaged in an attempt to utilize the wood; however, because many landowners could not be contacted, the majority of the attacked trees were not removed. While some top-kill occurred, no new faders were identified and the outbreak seems to have subsided. Losses in pinyon pine to ips were also encountered in the Payson area and increased publicity on this insect will be emphasized next spring. Individual sawtimber-size trees, attacked by ips beetle, were reported in the Pine area. Increased home construction and the accompanying slash production may be contributing to these losses.

Follow-up examinations of a section of private land southwest of Flagstaff revealed 150-200 ponderosa pines killed by engraver beetles. Green slash production probably precipitated the attack. However, the majority of the infested trees were sapling and pulpsize and in need of thinning. No further losses occurred during the summer and the outbreak seems to have declined.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., was identified for the first time on 2½ acres of private land north of Flagstaff, although it is known to occur in the general area. The insects were found attacking two overmature ponderosa pines (52-inch d.b.h.) in a mixed stand of aspen and limber pine. Because of the extreme age of the pines and the mixed nature of the stand, no major losses are anticipated. The only concern at this point is the young overstocked ponderosa pine stands in the vicinity as mountain pine beetle will attack smaller diameter trees during epidemic conditions.

Pinyon needle scale, *Matsucoccus acalyptus* Herb., emergence occurred early again this year in Prescott. The mild, wet weather in late

winter may have been a contributing factor. Below freezing temperatures in December and January apparently had little effect on the overwintering females. No environmental or biological control factors have had any impact on this chronic outbreak, and chemical and cultural control methods are almost useless. However, one observation has been noted, numerous trees appear little affected by the scale. Pinyon needle scale was also discovered on pinyon, north of Williams. This is probably an extension of the population present on the south rim of the Grand Canyon. The insect is infesting trees in a continuous stand of pinyon-juniper in an isolated area and should not become a problem.

A species of conifer sawfly, *Neodiprion* sp., has been defoliating ponderosa pine west of Springerville on Highway 260 since 1977, and possibly even earlier. The annual defoliation has caused some mortality, but the stand is of marginal value and is interspersed with large, grassy areas. The insects apparently prefer only those trees growing in the open. Adjacent, heavier stocked stands do not seem to attract ovipositing females. No explanation for this behavior can be given. As long as the sawfly stays in the open stand, no control should be necessary.

Pine needle miner, *Coleotechnites* sp., on ponderosa pine in the Show Low-Lakeside area was barely visible in 1979. The needle discoloration was very widespread last year, and the population seemed to be expanding. There is a strong possibility that freezing weather in December and January may have caused the drop in numbers. However, cold temperatures will not permanently suppress the insect. Endemic population will continue to inhabit the area. No major tree mortality is anticipated, and no evidence of secondary insect attacks has been discovered.

Other problems. Effects of low winter temperatures were evident at 6,000-7,000 foot elevations. Last year's growth was severely "burned," giving many ponderosa pines an overall reddish cast. New growth occurred in spring and no lasting effects were noticed. The greatest impact seems to have occurred on juniper species. Small trees growing in open areas and frost pockets suffered the most damage. Many produced basal sprouts later in the summer, but considerable mortality was observed. The location of these small trees and the large surface area to volume ratios probably were the principle causes of the winter-kill.

Brown leaf spot on Gambel oak was identified in the middle of summer, Statewide. Trees of all sizes were affected, and no distinctive pattern of spread was observed. The characteristic symptom of the leaf spot was the formation of dead, brown areas in the leaf. The areas varied in size and shape from small to large. Incubation of leaf samples in a moisture chamber produced no fungi capable of causing the spotting. Below normal temperatures in May and early June during the growth of new leaves, and record high temperatures and below normal rainfall at the end of June and July may have been the cause of the discoloration. However, no cause and effect can be determined, and the symptoms do not indicate "leaf scorch." Because of the hardiness of the species and its deciduous habit, no lasting effects of the leaf spot are anticipated. Normal leaf production is expected next year.

State of New Mexico Insect and Disease Conditions State and Private Lands

By Tony Smith [2]

Defoliating insects decreased dramatically on State and private forested lands throughout New Mexico in 1979. Tree damage and mortality were minimal. Aerial surveys over 1.2 million acres showed fewer than 5,000 acres of light western spruce budworm defoliation. Defoliation by the tussock moth was mainly restricted to ornamentals in Santa Fe and forested areas in Bear Canyon (Elena Gallegos Grant).

Overall, bark beetle activity in New Mexico was minor to insignificant. Western pine beetle activity was limited to areas near Ruidoso and Brazos, while isolated Douglas-fir beetle infestations killed trees east of the Carson National Forest.

Other insects of note included the pinyon needle miner and pinyon needle scale.

Hail damage in July of 1979 also resulted in light to heavy defoliation to ponderosa pines.

Western pine beetle, *Dendroctonus brevicomis* LeC. Western pine beetle activity throughout New Mexico's State and private lands was low to insignificant. Scattered ponderosa pine mortality from this beetle was observed near Ruidoso and near Brazos. In both of these areas, dwarf mistletoe had contributed to tree decline.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Scattered Douglas-fir, singly and in groups of 10-40 trees, were killed by this beetle in remote areas east of the Carson National Forest. Overall mortality, however, was substantially less than that reported in 1978. Further decreases in population levels and associated tree mortality are expected in 1980.

2 *Forest entomologist with New Mexico Department of Agriculture.*

Western spruce budworm, *Choristoneura occidentalis* Free. Western spruce budworm activity in northern New Mexico decreased for the second consecutive year. Total acres defoliated on the Philmont Scout Ranch-Angel Fire region near Cimarron decreased from 7,000 acres in 1978 to fewer than 5,000 acres in 1979. Egg mass surveys conducted in the fall indicated additional defoliation would be light to moderate in 1980.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.) Tussock moth larvae continued to defoliate ornamental spruce, true fir, and Douglas-fir in central and eastern New Mexico. In Santa Fe, ornamentals were defoliated for the 12th consecutive year. Total number of trees defoliated in Santa Fe in 1979 exceeded that of 1978 by 20 percent. In Los Alamos and Ruidoso, defoliation by the tussock moth was insignificant.

A cooperative effort between Federal, State, and private agencies was conducted in Bear Canyon (Elena Gallegos Grant) to suppress the tussock moth. Approximately 600 acres of the infested Elena Gallegos Grant were treated with a nucleopolyhedrosis virus. The virus treatment was applied with a fixed-wing Marsh Turbo Thrush, flying at 150 miles per hour. Presuppression larval densities were near 200/1,000 inches^2 of foliage. Larval mortality at 42 days post-treatment was 99.7 percent. No new egg masses were found in November 1979. Larval surveys will be conducted again in the spring of 1980 to determine population levels and infestation trends.

Pinyon needle miner, *Coleotechnites* n. spp. Infestations of this insect continued to defoliate pinyons west of Taos for the 8th year in a row. Defoliation was light to moderate over 3,000 acres, and tree mortality noticeably higher than in 1978. Most live trees were characterized by few needles and many dead branches.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. New infestations of the pinyon needle scale were detected east of Santa Fe. Approximately 300 acres of mixed private land ownerships were infested. Populations ranged from light to very heavy. A cooperative suppression project by individual landowners is being considered.

Other insects. In the larger population centers of northern New Mexico, attacks on the larger branches, limbs, and trunks of young ponderosa and pinyon pines by the larvae of *Petrova* spp.; *Vespamima* spp.; *Dioryctria* spp.; *Rhyacionia* spp.; and *Ips* spp., continued to be major problems. Many of these problems stem from

wilding collectors who dig trees from uninspected areas and/or do not dig nor handle them appropriately. For example, balled trees are often held for long periods without water. Consumers should only buy trees from reputable, licensed dealers, and be wary of very low-priced, "bargain" trees.

Hail damage. Over 300 acres of pole-sized ponderosa pines on private lands northwest of Las Vegas were damaged by hail. Defoliation resulting from this damage ranged from light to heavy with approximately 60 acres completely defoliated. In some instances, the bark on the east side of the tree trunks and upper limb surfaces was stripped away.

Recent Publications

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